Chapter 4

USER SURVEY RESULTS

This chapter summarizes and analyzes significant results of a survey sent to Caltrans staff regarding RWIS use.

The survey was created and sent to Caltrans RWIS users in order to assess the attitude about RWIS, how each District uses their system, and to identify problems involved with using RWIS. The Technical Advisory Committee (TAC) identified 37 primary users of RWIS in California, and Caltrans New Technology sent a request to complete the electronic survey to those identified on January 10, 2002. TAC members were also given the option of forwarding the survey to others as deemed appropriate. The identified survey responders include road maintenance, traffic and operations personnel, District management, and headquarters personnel. There were 27 responses returned on the Internet. Ten paper surveys were completed when WTI employees performed District visits for a total of 37 surveys returned and evaluated out of 47 requests for responses.

Methodology of Survey

The purpose of this survey was to determine why Road Weather Information Systems (RWIS) are not being used to their full potential. The survey was designed to elicit specific responses to the questions asked. The detailed information generated by the survey was used to evaluate how Caltrans personnel felt about RWIS and to compile their recommendations for system improvements.

The survey was designed to take approximately thirty minutes while still asking the appropriate questions. The format of the survey was designed to be user-friendly and understandable.

The survey was computer generated so the respondents could simply fill out their surveys on the computer and then submit their responses through e-mail. This eliminated the need to mail out surveys and then wait for them to be returned. The responses to the surveys were automatically stored in a Microsoft Access database. This eliminated the time involved with entering the responses by hand

along with the errors that can occur when typing in each response. The responses were then analyzed in Excel.

The respondents who didn't get a chance to complete the survey online were able to fill out a paper survey. WTI gave the opportunity for participants to complete this survey while attending the District meetings.

There are three different types of questions in this survey. The first type of question asks the respondents to rate different aspects of RWIS. The ratings were ranked from a value of 5 to 1. A value of 5 could either represent the highest-ranking possible, a very useful technique, or strong agreement with the statement. A value of 1 represents the lowest-ranking possible, a technique that is not useful, or strongly disagreeing with the statement.

An example of this type of question is question 2. It states, "How often do you use these methods to obtain weather information for making weather-related decisions in your job?" The respondent is only allowed to check one response for each method. The answer of this question could be ranked from Very Often (5) to Never (1). The rankings correspond to the type of question that is asked. Most of the questions contained in this survey consist of this type of question.

The second type of question allows the responder to answer the question with more than one response. An example of this type of question is question 3. It states, "It other methods for delivery of weather information were provided, which would be desirable? (Select any that apply.)" This enables the respondent to check more than one option.

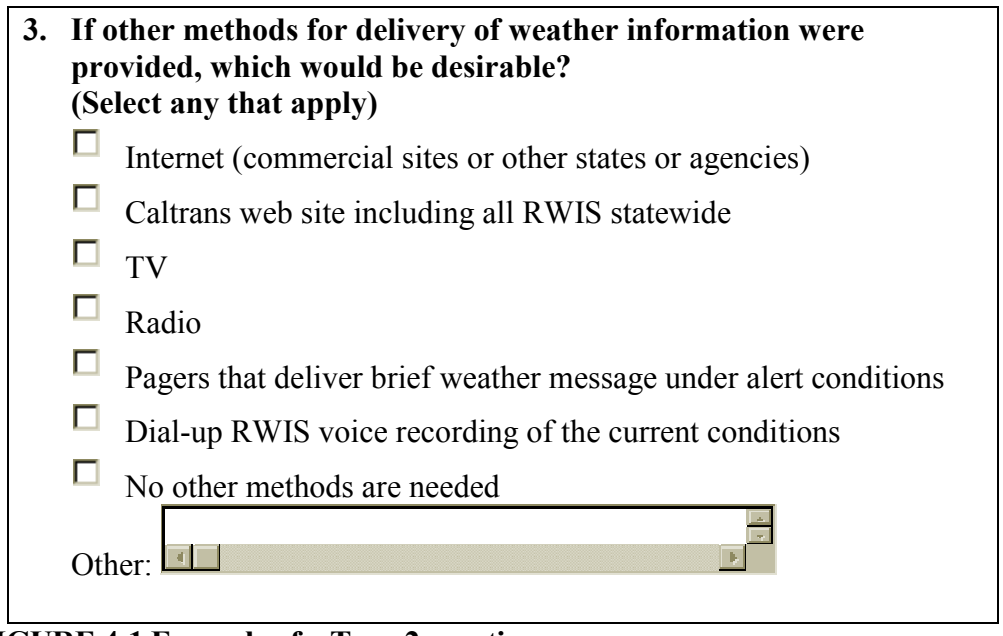

FIGURE 4-1 Example of a Type 2 question.

The third and final type of question solicits comments. This type of question allows the respondent to write suggestions in a textbox. An example of this type of question is question 13. It states, "Provide any recommendation for new locations or relocation of existing stations." This type of question allows the respondent to give their suggestions or feelings on the subject. The text responses were harder to analyze, but contained a lot of useful information.

Provide any recommendations for new locations or relocation of existing stations.

FIGURE 4-2 Example of an open-ended question.

Survey Results Analysis

Before the results were analyzed, they were sorted according to the regions of the state and the main RWIS usage. Each District of the state was asked to rank the impact that certain weather events had on travelers, traffic operations and maintenance. These rankings were used to split the Districts into three groups: Snow and Ice, Wind and Visibility, and Low Usage. Group 1 Districts are the Districts that use RWIS mostly for snow and ice incidents. Group 2 Districts mostly use RWIS for low visibility and wind incidents. They also have snow and ice conditions in certain areas, but most of their RWIS use is concentrated around wind and low visibility conditions. Group 3 Districts have low RWIS use. Some Districts had a mix between snow and ice and low visibility and wind uses. The classification of each District can be seen in FIGURE 4-3.

The survey analysis was completed by analyzing the respondent's answers and comparing the results. Because each question had several different parts and the data was split into three groups, the data was hard to show in an effective manner without taking up too much room. To solve this problem, the results of each group were joined into one table. The mean value was then calculated for each individual part of the question. Based on the mean values, the individual parts were then ranked. This was done for the combined results of all three groups.

After comparing the data, a few main points were determined. Because of the low amount of surveys that were sent out, the survey is not statistically valid. Nonetheless, the information that was obtained was very insightful. The small survey also resulted in very high standard deviations. The standard deviations for each part of a question were usually around the 1.0 value. In a question where the

range is from one to five, a standard deviation of one is extremely high. The low number of surveys can explain this.

The survey results analysis that follows below does not include all of the questions provided in the survey. An analysis is provided for select questions only, those considered to have the most important results. A complete tabulation of survey results is given in Appendix A.

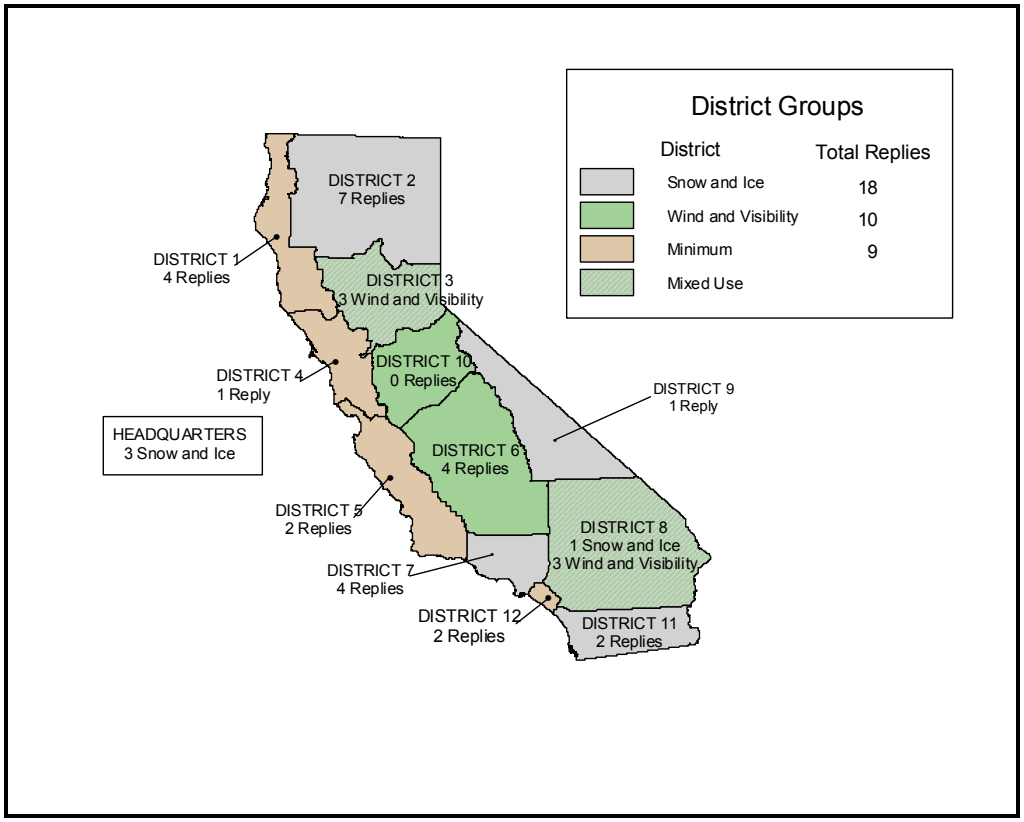

FIGURE 4-3 Survey respondents.

General RWIS Information

Question 7 asked the respondents to evaluate the general use of RWIS. It states, " Please indicate to which level you agree with the following statements," followed by 18 statements regarding RWIS access, data, locations and other issues. This question was one of the most informative questions asked during the survey. This question helped determine how Caltrans employees feel about RWIS information and its accuracy, the general use of RWIS, and some ideas to improve RWIS use for later. Some main points that were determined include:

- Suggestions for RWIS Improvement

- 67% feel that RWIS would work better if there were more sites (i.e., responders strongly agreed or agreed with statement)
- 41% think that RWIS would work better if the sites were better located
- 47% believe that RWIS would work better if the sites were maintained better
- 50% of the respondents feel RWIS would be more useful if more people knew how to use it

- Level of RWIS Use
  - 58% feel they are encouraged to use RWIS
  - 64% agree that RWIS is used in their district for winter road maintenance
  - 40% agree that RWIS is used in their district for traffic operations
- Quality of RWIS Information
  - 56% of the respondents feel that RWIS is accurate
  - 65% of the respondents feel that the RWIS information is current

The results to each part of question 7 are given in TABLE 4-1.

TABLE 4-1 Level of Agreement with Use of RWIS

Please indicate to which level you agree with the following statements						
	Strongly Agree **5**	**4**	**3**	**2**	**Strongly Disagree** **1**	**Rank**
I can access RWIS data in my workplace	**71%** 20	**7%** 2	**7%** 2	**7%** 2	**7%** 2	1
Accessing RWIS information is easy and requires minimum effort	**48%** 16	**21%** 7	**6%** 2	**15%** 5	**9%** 3	9
When I view RWIS data, I feel that the temperatures and other data is accurate for the time reported	**31%** 10	**25%** 8	**31%** 10	**3%** 1	**9%** 3	11
When I view RWIS data, I feel that the reported data is current	**26%** 8	**39%** 12	**26%** 8	**3%** 1	**6%** 2	10
Monitoring road conditions and weather forecasts is important in doing my job	**65%** 24	**11%** 4	**11%** 4	**3%** 1	**11%** 4	3
I am encouraged to use RWIS and weather information	**42%** 13	**16%** 5	**13%** 4	**19%** 6	**10%** 3	12
RWIS help monitor road weather conditions	**50%** 16	**31%** 10	**13%** 4	**6%** 2	**0%** 0	2
Cameras help monitor road weather conditions	**41%** 14	**32%** 11	**18%** 6	**6%** 2	**3%** 1	5
In my district, RWIS is used as a tool for traffic operations, such as fog or high wind warnings	**27%** 8	**13%** 4	**13%** 4	**23%** 7	**23%** 7	17
In my district, RWIS is used as a tool for winter road maintenance (snow and ice control)	**50%** 14	**14%** 4	**18%** 5	**7%** 2	**11%** 3	8
In my district, RWIS is used as a tool to schedule and monitor maintenance and construction jobs	**7%** 2	**19%** 5	**26%** 7	**15%** 4	**33%** 9	18
RWIS would work better if there were more of them	**42%** 14	**24%** 8	**21%** 7	**3%** 1	**9%** 3	7
RWIS would work better if they were better located	**22%** 7	**19%** 6	**28%** 9	**9%** 3	**22%** 7	16
RWIS would work better if they were maintained better	**23%** 7	**23%** 7	**23%** 7	**10%** 3	**20%** 6	15
RWIS would work better if people knew how to use the information better	**38%** 12	**13%** 4	**31%** 10	**6%** 2	**13%** 4	13
RWIS would work better if the information was easier to use and interpret	**23%** 7	**19%** 6	**32%** 10	**10%** 3	**16%** 5	14
RWIS data should be included in the ATMS	**52%** 16	**16%** 5	**16%** 5	**6%** 2	**10%** 3	6
RWIS data should be posted on the Internet for public access	**65%** 22	**9%** 3	**9%** 3	**3%** 1	**15%** 5	4
Comments: Caltrans needs to post RWIS on the Web. Info is extremely unreliable When Rwis available						

More detailed results, including the means and standard deviations, can be seen in the Appendix.

Methods of Obtaining Information

Another important question deals with the methods of obtaining information to make weather related decisions. Question 2 asked, "How often do you use these

methods to obtain weather information for making weather-related decisions in your job?" Based on the results, using RWIS to obtain weather related information ranked third. Getting information from non-Caltrans Internet websites was the most popular way of obtaining weather information, and televised weather reports ranked second. Group 2 (low visibility/wind districts) results showed that most people who responded used RWIS as the best method of obtaining weather information. Group 1 (snow and ice districts) and group 3 (low use districts) respondents used non-Caltrans Internet websites to obtain most of their weather information.

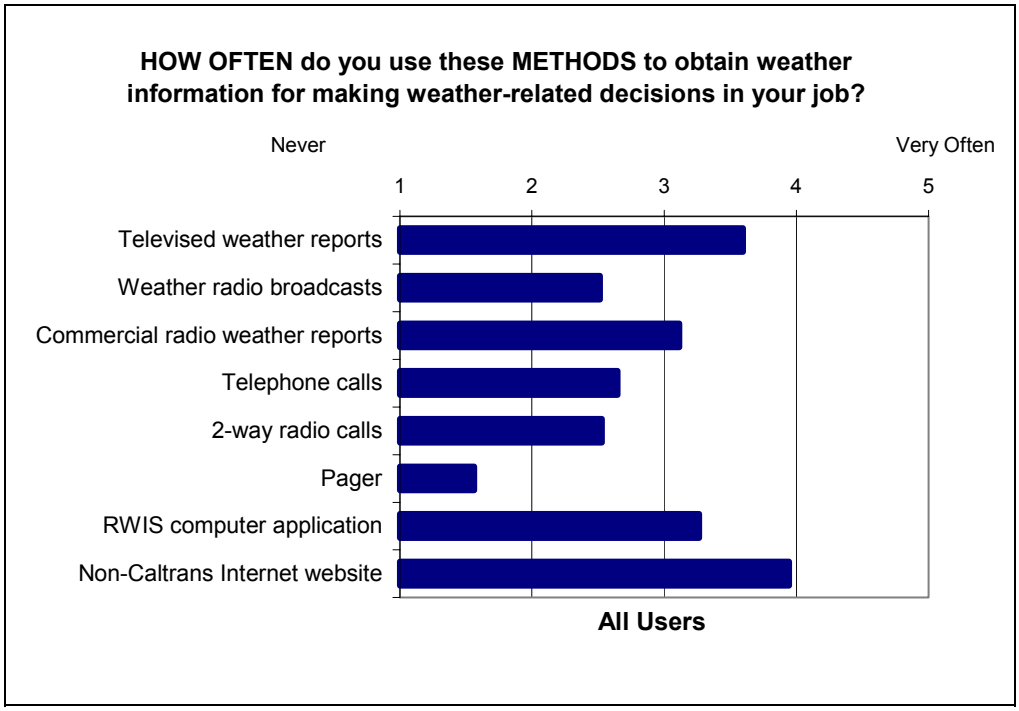

FIGURE 4-4 Methods of obtaining weather information.

The results of each user group can be found in the Appendix.

Training

Another question with interesting results addresses the issue of training. Question 20 asked, "In the past two years, how many hours of training have you received in obtaining, interpreting, and using RWIS information?" 87% had less than eight hours of training or no training at all. As a follow-up, the second part of question 20 asked, "How would you classify this amount of training?" The results of the survey showed that a majority of the respondents felt that the amount of training was not enough: 69% felt that they had received less than adequate or minimal amounts of training. Only 31% thought the amount of training received was correct or more than adequate.

Only 31% of survey respondents felt that the amount of training received on RWIS was correct or more than adequate.

In the past two years, how many hours of training have you received in obtaining, interpreting, and using RWIS information?

Over 40 hours	0	0%
20 - 40 hours	1	3%
8 - 20 hours	4	11%
Under 8 hours	15	41%
None	17	46%
Total	**37**	

How would you classify this amount of training?

Excessive	0	0%
More than adequate	4	14%
Correct amount	5	17%
Less than adequate	7	24%
Minimal	13	45%
Total	**29**	

FIGURE 4-5 Amount of training received.

Usefulness

The highest rated potential use of RWIS was to provide drivers with snow and ice weather information to the traveler.

Question 6 addressed about the potential of RWIS for differing purposes: "Rate the potential usefulness of RWIS and VAMS for the following functions." The highest rated potential use of RWIS was to provide drivers with snow and ice weather information to the traveler (see FIGURE 4-5). All other options provided received a positive ranking (i.e., average greater than 3 on 5 point scale) except intense rain traveler information. Group 1(snow and ice) ranked snow and ice control slightly higher than the other groups, ranking it with snow and ice traveler information as a top potential. Group 2 (wind and visibility) rated use for low visibility traveler information and high winds traveler information as the greatest potential. The low use group (Group 3) rated all uses but one lower than the other groups, with all averaging 3 or lower. The only use this group rated higher was the potential for intense rain traveler information.

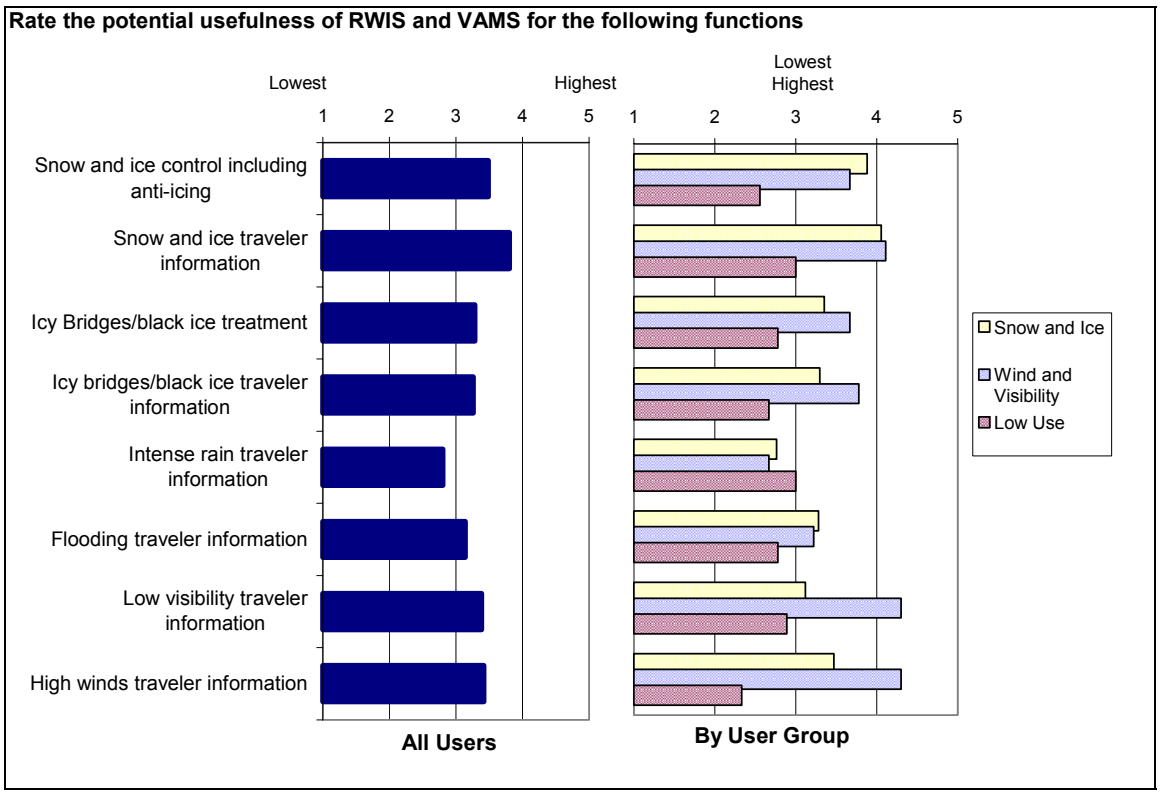

FIGURE 4-6 Potential usefulness of RWIS.

Another question that deals with the usefulness of RWIS in traffic operations and traffic management is question 8 (see FIGURE 4-6). It states, "How useful is the following specific site information for the purpose of traffic operations and traffic management (e.g., incident reporting; providing fog, ice, or high wind warnings to drivers)?" The purpose of this question was to determine which data was considered to be important in making operations and management (O&M) decisions. Looking at the combined results, it was determined that precipitation and snowfall was the most important type of information for O&M. The second most useful RWIS information for O&M was determined to be visibility data. The third most useful information was the forecasted conditions. Dew point and relative humidity were determined to be the least useful information for making O&M decisions. Group 1's individual results showed that the respondents felt that the forecasted conditions were the most important information from RWIS. Group 2's individual results had three types of information tied for the most useful for O&M decisions: wind speed and direction information, precipitation and snowfall information, and the visibility data. Group 3 results also had a two-way tie. Their top two responses were the pavement temperature and the forecasted conditions.

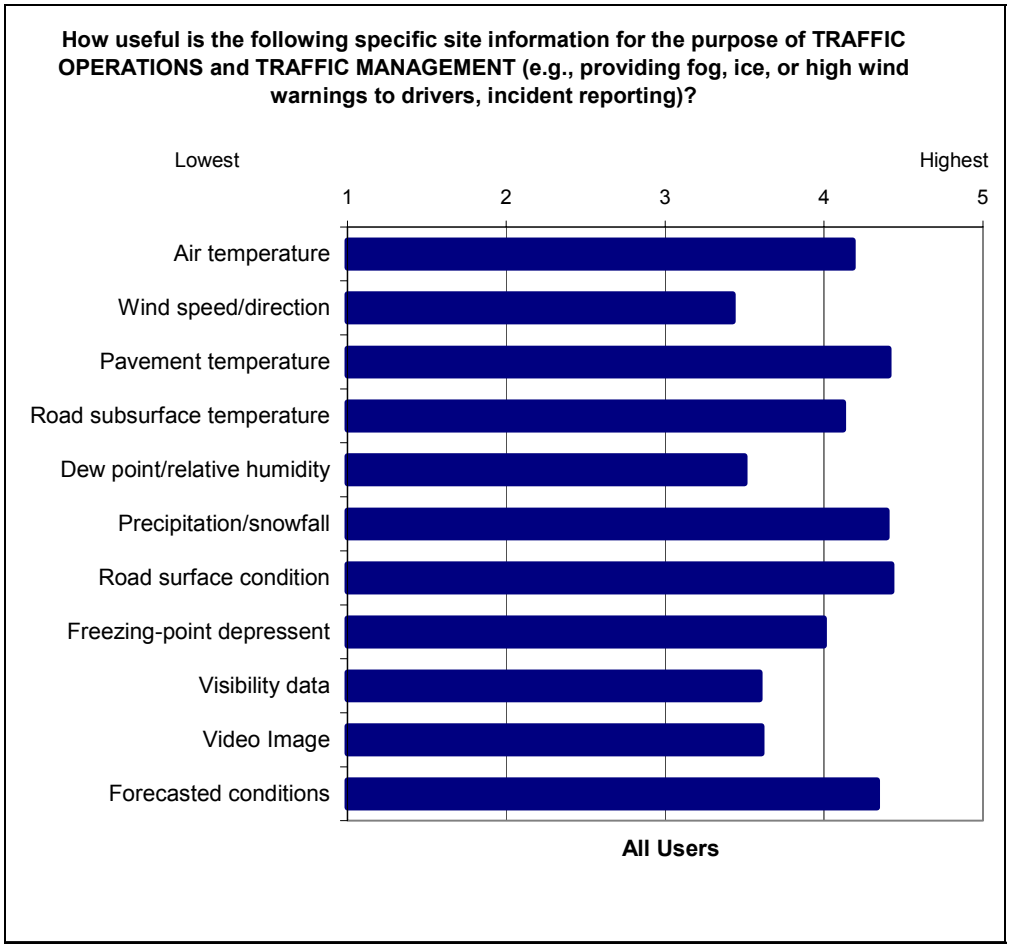

FIGURE 4-7 Useful traffic operations information.

The survey also included a question that determines the importance of RWIS information for determining when winter road maintenance is needed. Question 9 asks, "How useful is the following specific site information for the purpose of winter road maintenance (e.g., plowing, anti-icing, de-icing)?" Looking at the combined results, two types of information were determined to be the most useful for winter maintenance decisions. These two information sources were precipitation and snowfall data and the forecasted conditions. Pavement temperature and road surface conditions were two more types of information that were rated very highly for winter maintenance decisions. The wind speed and direction was the information that was reported to be the least useful. Group 1 results showed that pavement temperature is the most important information for determining winter maintenance. Group 2 respondents felt that two information sources were the most important when deciding when to use maintenance: precipitation and snowfall, and the road surface condition. Group 3 respondents felt that the forecasted conditions were the most important information for winter road maintenance.

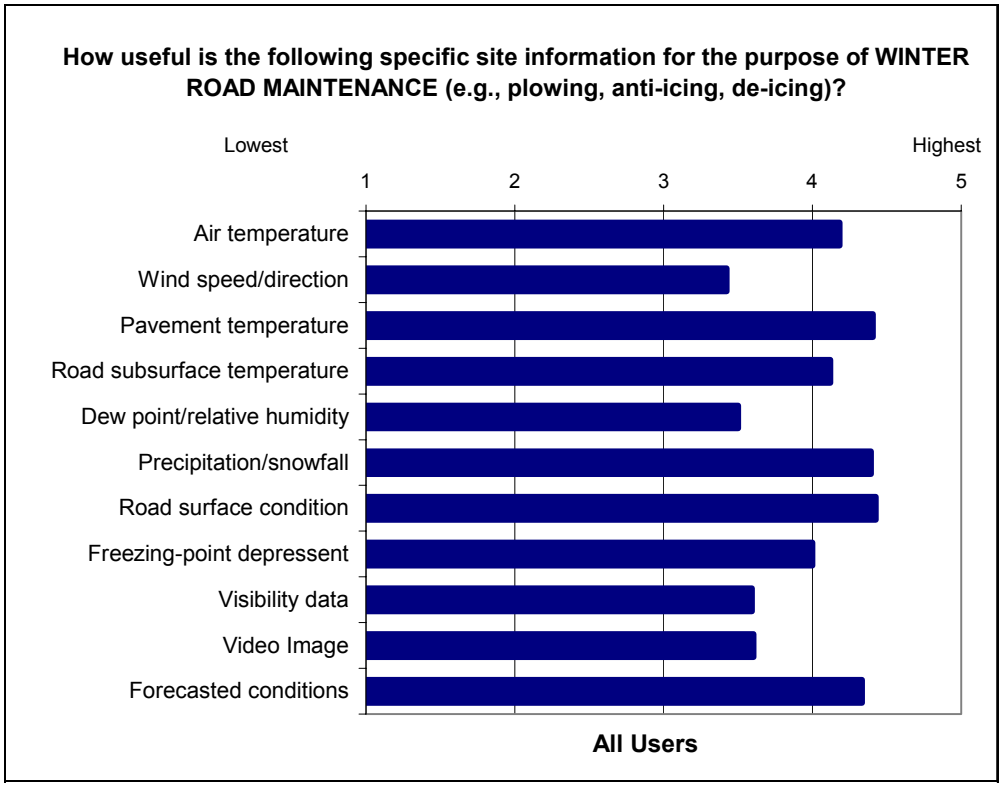

FIGURE 4-8 Useful winter maintenance information.

83% of the respondents want to make RWIS easy to read and interpret.

Question 15 deals with potential functions and how they could increase the usefulness of RWIS data by displaying it a more appropriate way. It reads, "Rate the potential usefulness of the following functions in displaying road weather information in a computer application," followed by 10 options for system changes or expansion. The most important point that was determined from this question deals with employees wanting to be able to easily interpret the data. 83% of the respondents want to make RWIS easy to read and interpret. The individual results to this part of the question and the others can be seen in TABLE 4-2.

TABLE 4-2 Usefulness of Functions in RWIS Computer Application

	Highest 5	4	3	2	Lowest 1	Rank
Integrate RWIS data with radar or satellite images	**38%** 14	**27%** 10	**22%** 8	**11%** 4	**3%** 1	4
Make RWIS data easy to read and interpret	**64%** 23	**19%** 7	**11%** 4	**0%** 0	**6%** 2	1
Display color-coded RWIS data (e.g., pavement temperature, wind speed and direction) directly on map of RWIS sites	**41%** 15	**27%** 10	**27%** 10	**0%** 0	**5%** 2	3
For a length of road, provide estimated current precipitation rates and types	**28%** 10	**25%** 9	**36%** 13	**3%** 1	**8%** 3	6
Display graph of short-term history of RWIS data	**14%** 5	**22%** 8	**50%** 18	**8%** 3	**6%** 2	8
Provide historical traffic volumes by time of day	**14%** 5	**14%** 5	**36%** 13	**19%** 7	**17%** 6	10
Incorporate observations from field personnel (plow drivers, traffic management team, highway patrol, etc.)	**31%** 11	**31%** 11	**22%** 8	**8%** 3	**8%** 3	5
For a length of road, provide estimated current temperatures	**26%** 9	**31%** 11	**20%** 7	**11%** 4	**11%** 4	7
For a length of road, provide forecasted conditions	**50%** 18	**25%** 9	**17%** 6	**3%** 1	**6%** 2	2
Show locations of current accidents	**28%** 10	**11%** 4	**28%** 10	**17%** 6	**17%** 6	9
Other:	0	1	0	0	1	
Display of current NWS Watches and Warnings accidents at locations we can use information from TMC roadway conditions (traffic speed)						

Site Location

Determining the potential location of RWIS sites was another important part of this survey. Certain questions were used to determine where sites should and shouldn't be located. Question 14 asks, "How important is it to place RWIS in the following locations?" Six types of locations were listed for review. Looking at the combined data, the highest ranked type of location for RWIS was roads prone to snow and ice with the highest volumes of traffic. The second most important site location was determined to be mountain passes and other roads with severe snow and ice weather. The least important place to locate an RWIS site was roads prone to intense rain and flooding problems. Group 1 individual data results also showed that they felt that mountain passes and other roads with the most severe snow and ice weather are the most important locations for RWIS sites. Group 2 respondents determined that roads prone to low visibility and high winds with the highest traffic volumes should have the highest priority when determining where to place the sites. Group 3 respondents felt that roads prone to ice and snow with high traffic volumes should be the most important RWIS site locations. The results of question 14 can be seen in FIGURE 4-8.

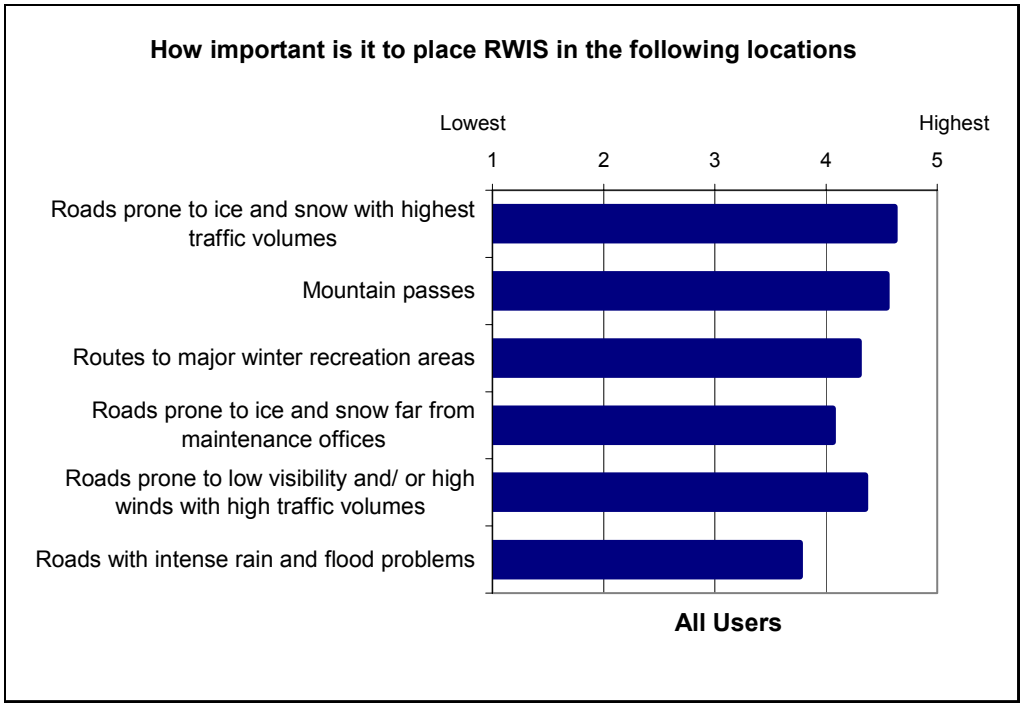

FIGURE 4-9 Importance of placing RWIS.

Question 13 also deals with site location. It is a type three question, and it asks respondents to, " Provide any recommendations for new locations or relocations of existing stations." Out of the 15 group 1 respondents, eight gave comments to this question. Four of these responses dealt with moving certain sites. One respondent commented that procedures and requirements for selecting locations and configurations of systems should be set in policy prior to installing any new sites. They also suggested that a study be conducted to determine the best locations after the policy is put into effect. See Appendix C for a list of sites suggested.

Accuracy

Questions 11 and 12 deal with the accuracy of current RWIS sites. These questions are also type three questions. Question 11 asks, "What specific roadside locations are prone to having outdated data? (e.g., data from RWIS often appears to be 6 hours old.) Specify location, and what type of data is typically not current." Eleven of the eighteen group 1 respondents answered this question. See Appendix C for comments.

Out of the ten group 2 respondents, six of them answered question 11. One respondent responded that any site that uses cell phone coverage to relay the information to the Traffic Management Center is unreliable. The actual sites that were reported as not being current can be seen in FIGURE 4-10.

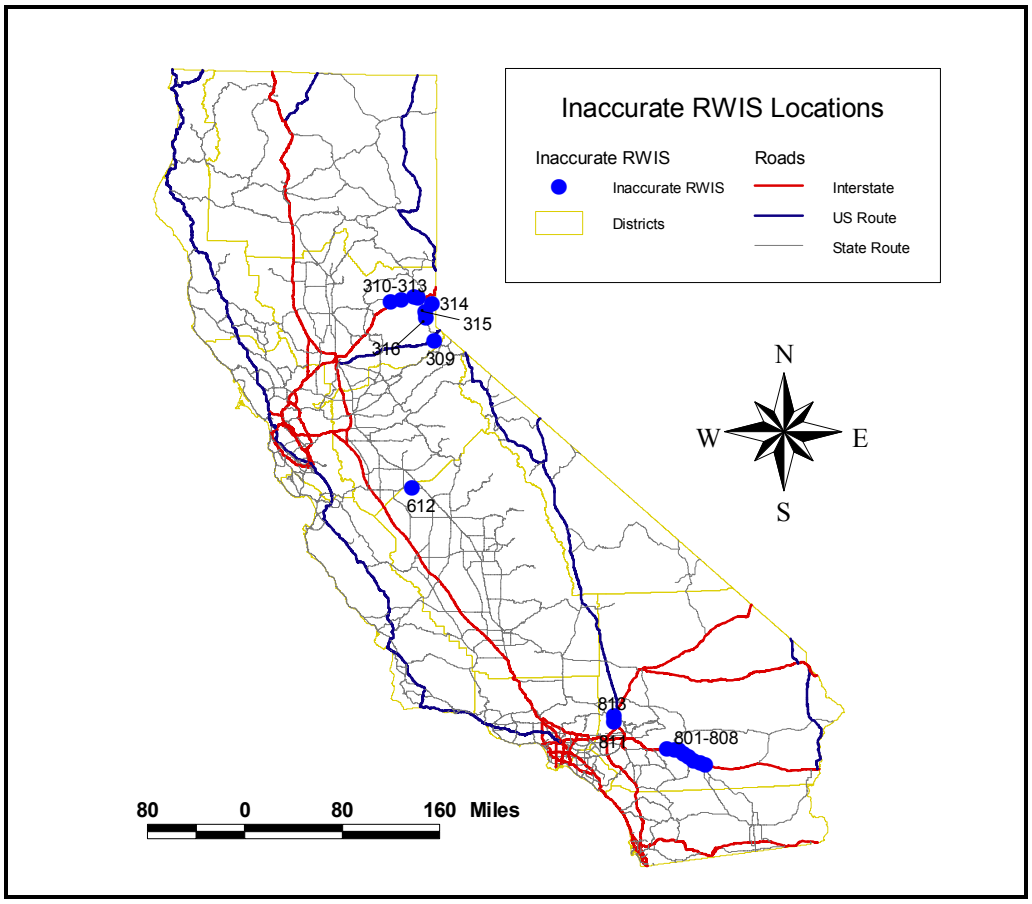

FIGURE 4-10 Inaccurate RWIS sites.

Four of the nine group 3 respondents made comments concerning question 11. Three of the respondents did not know that information or have it available for this question. The other respondent gave the following information:

- A current site will be relocated to Hum 101 P.M. 133.2

Question 12 also deals with the accuracy of current sites. It states, " What specific roadside locations are prone to the data being inaccurate? (e.g., pavement temperature is usually 10 degrees warmer than actual conditions) Specify location, and what type of data is typically not current." Out of the group 1 respondents, nine of the eighteen responded to this question. Three of the ten group 2 respondents answered question 12. Group 3 respondents did not have any information concerning question 12.

Statewide Summary

More than one third of surveyed Caltrans District staff rarely or never use RWIS.

After looking at all of the data obtained from the survey, some important facts emerged. It was determined that more than one third, or 36%, of surveyed Caltrans District staff rarely or never use RWIS (Question 2). Televised weather reports and non-Caltrans websites are the services that are used most often to obtain information about future weather conditions, even though RWIS is available. It was also determined that 29% of the respondents are not encouraged to use RWIS (Question 7). One reason this may occur is because 87% of the respondents have received less than eight hours of training. Out of all of the respondents, 69% thought that this amount of training is inadequate (Question 20). In order for Caltrans to effectively use RWIS, the employees have to understand how to use the data to help them with their everyday tasks. Once the employees have been trained, they will be able to use RWIS to make their job easier. More training will increase RWIS use because people will be able to understand what they are doing and how the data can simplify their positions. Most of the respondents, 83%, felt that the most important component of a computer application is to make the RWIS data easy to read and interpolate (Question 15). Making the data easy to read and understand will increase the use of RWIS.

Most of the respondents, 88% overall, thought that it was important that RWIS be placed on roads prone to snow and ice with high traffic volumes.

The survey also helped determine staff views on how RWIS could be used in a better manner. 67% of the respondents agreed that RWIS would be more effective if there were additional sites located throughout the state. This would increase the amount of information available and improve forecasting abilities. Out of the respondents, 41% felt that the system would also be more effective if the sites were located in better positions (Question 7). This change would also increase the amount of information obtained and improve its quality.

Another important fact that was determined was that it was important to place RWIS on sites where snow and ice occurred. This also includes areas where icy bridges and black are present. Most of the respondents, 88% overall, thought that it was important that RWIS be placed on roads prone to snow and ice with high traffic volumes. Respondents also felt that snow and ice information was very important for traffic operations, maintenance, and statewide travelers.